United States Department of the Interior

BUREAU OF LAND MANAGEMENT
WASHINGTON, D.C. 20240

IN REPLY REFER TO
9670 (730)

August 30, 1984

Information Bulletin No. 84-323

To: SD's and SCD

From: Director

Subject: Information Exchange for Mapping and Related Programs

In recent months many States have developed Handbooks, Interagency Agreements, etc. to assist the users of mapping and related program services in understanding what is available, and how to obtain the services. We do not have a formal mechanism to share State-developed information with other States, so we frequently end up with States developing guidelines with no awareness of what others have already accomplished.

This memorandum is meant to begin an interim procedure of exchanging information by transmitting two recently State-developed products, a Users Guide and an Activities Report prepared by Alaska, for your information and use. The procedure is simply that 15 copies of State-developed information or agreements that you feel would be helpful to other States are to be forwarded to the Director (730). We will in turn distribute appropriate material to all other States on a quarterly basis.

It is not intended that information forwarded from the Washington Office in this manner be regarded as a preferred method or as policy, but rather as a mechanism for information transfer that can be used by all offices. It will be standard practice that comments are welcome and they should be forwarded directly to the office responsible for development of the information with a copy to the Director (730).

I want to thank the Oregon and Alaska staffs for their initiative and effort in compiling the enclosures and for sharing these products with us.

Questions may be referred to Dave Meier, 653-8798, or Duane Tabb, 653-8811.

John D. Tabb
Chief, Division of Engineering

2 Enclosures (to addressees only):
Encl. 1 - Cartographic Users Guide
Encl. 2 - Alaska - Mapping - Automated Cartography - Remote Sensing

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TABLE OF CONTENTS

CHAPTER

100 - DOI - BLM - OBJECTIVES

200 - CARTOGRAPHY SECTION

201 - Base Series Mapping

202 - Map Compilation

203 - Orthophotography

204 - Automated Cartography

205 - Photoreproduction

206 - Remote Sensing

300 - PHOTOGRAMMETRY UNIT

301 - Aerial Photography

302 - Aerotriangulation

303 - Photogrammetric Compilation

400 - CADASTRAL SURVEYS SECTION

401 - Oregon State Office Contact

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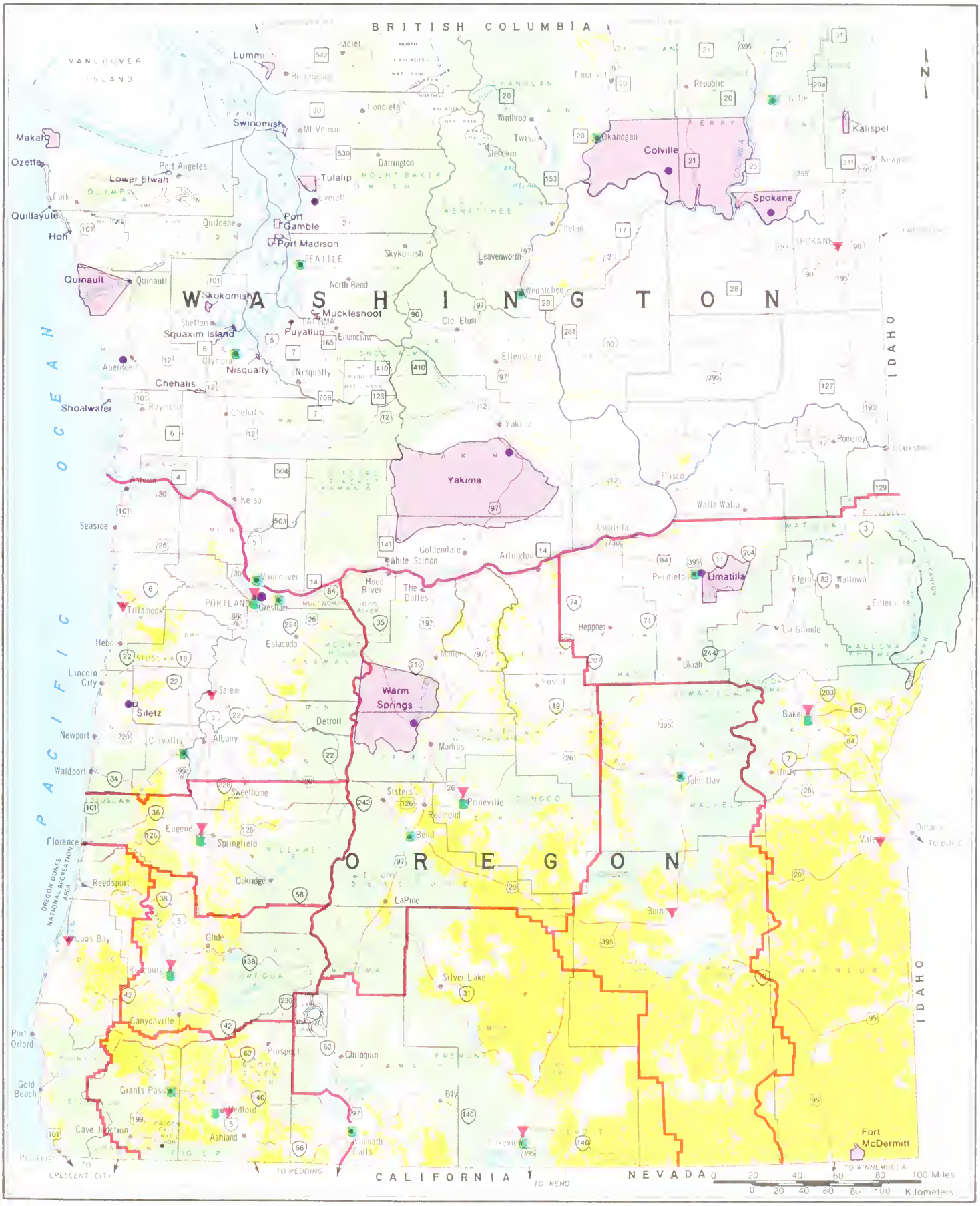
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*GPO 793-229 (1983)

DOI - BLM - OBJECTIVES

CHAPTER 100 - U.S. DEPARTMENT OF INTERIOR, BUREAU OF LAND MANAGEMENT OBJECTIVES OREGON STATE OFFICE

I. Objectives of Cartography

1. To provide maximum assistance to Bureau of Land Management land managers through economical, timely, and accurate professional cartographic services.

2. To use computer technology for resource-data storage, retrieval, and processing. It is imperative that the data stored be defined by geographic or geodetic coordinates to fit maps of standard formats, scales, and accuracies for all Bureau of Land Management lands.

3. To utilize the layered mapping concept to facilitate preparation of composites quickly and economically.

4. To eliminate duplicated effort in all surveying and mapping operations at all levels of management.

5. To maximize the use of labor saving opportunities available through metric and high-resolution aerial photography, photogrammetry, automatic degitizing and plotting, infrared and radar imagery, electronic distance-measuring devices, and other modern techniques and products.

6. To develop new, improved, or superior cost effective procedures and equipment.

II. Responsibilities

A. Washington Office

1. Establishes policy, guidance, and direction.

2. Investigates, develops, and distributes information on new and improved cartographic systems and techniques.

3. Obtains clearance under Secretary's delegation for aerial photography projects.

4. Coordinates all mapping done by the Department of Interior as delegated by the Secretary.

5. Provides direction for and conducts investigation of developmental projects.

6. Evaluates project activities and results prior to the adoption of equipment or techniques for district-wide use.

7. Produces mapping materials for 100K Base Series and project materials in support of State office programs through the Denver Service Center (DSC), Cadastral Section, Washington Office.

8. Sponsors development of remote sensing analysis techniques for problems arising from the need to inventory, monitor, and manage forests and rangelands.

9. Represents the Secretary of Interior on the U.S. Board on Geographic Names.

B. State Office

1. Provide pertinent Division guidelines for compliance with Bureau-wide policies.

2. Supervise and direct surveying, remote sensing, photogrammetry, computing, cartography, and graphics activities.

3. By assignment, conduct developmental work for improvement of procedures and techniques.

4. Ensure that the content, accuracy, and currency of the 1:100,000 Base Series maps are as described.

5. Develop, construct, and maintain resource inventory, and management data plates, and functional layers for producing composites as cartographic products.

6. Provide cartographic products and services to meet Bureau of Land Management needs.

7. Coordinate State effort for geographic names investigations.

8. Provide input for ADP inventories and data bases for use in management of resources and transportation system.

C. District Managers

1. Keep a reference atlas of aerial photographic coverage available.

2. Maintain 100K base series correction, annotated to record revision data needed to update bases.

3. Initiate and make field investigations for geographic names proposals as requested.

III. Other Products and Services (as required)

ACTIVITY	STATE OFFICE ORGANIZATION
Resource Photography	Aerial Photography
Photogrammetric Mapping & Digitizing	Aerotriangulation and Photogrammetric Compilation
Wilderness and National Recreation Area Mapping	Map Compilation
X - Y Digitizing & Automated Cartography	Automated Cartography (to be added)
Photographic Services	Photoreproduction
Surveys	Cadastral Surveys

CARTOGRAPHY SECTION

CHAPTER 200 - CARTOGRAPHY SECTION

The Cartography Section provides technical support and guidance in the preparation and use of base maps and orthophotos. These graphics are the Bureau of Land Management's basic tools for the effective management of the various resources.

In addition, the Cartography Section specializes in the application of digital data bases and techniques in support of State Office and Resource Management activities.

Standard products and services provided by the Cartography Section to the State Office and District offices include 1:100,000 Base Series maps, orthophotos, recreation maps, wilderness maps, special area maps, photoreproduction contracting service, automated cartography service, and consultation and training in all cartographic specialties.

Design of alternate mapping approaches is appropriate when base series materials are not of suitable scale, or accuracy does not meet the project needs, and will be provided to the user as required.

It is our contention that a clear understanding of the various cartographic processes will result in better or more appropriate map or photo products. To this end, we strongly encourage inquiries to the specialized area or areas needed to fulfill your particular need.

Base Series Mapping

CHAPTER 201 - BASE MAPPING

The Bureau has adopted a base series mapping system to achieve uniform Service-wide mapping formats and standards. These maps are constructed using the separation-plate or layer system. The 1:100,000 scale quadrangle maps produced by the USGS serve as the common base for new maps.

The Bureau's base Series Mapping Unit will provide the following base maps to be used in land use planning and management:

100K Base Series

The Bureau is presently undergoing a transition from the Master Unit Maps ½"=1 mile scale and 30' quadrangle 1"=1 mile scale to the Primary Base Series maps in 1:100,000 scale.

The Primary Series Maps will be constructed in a layer system using the existing U.S. Geological Survey quadrangle as a base. Conversion of this basic data to conform to Bureau of Land Management Symbols and updating of the map information will be coordinated by the Base Series Mapping Unit.

The layer system will afford the option of a variety of map products to fit a particular need and will also allow the opportunity of producing functional layers for a special use. We invite your inquiries as to the variety of products available as well as the appropriate technique for producing functional layers to enhance the 100K Series Map.

CHAPTER 202 - MAP COMPILATION

The Cartographic Compilation Unit offers the following products and services:

Maps produced on a regular cycle

1. 1:100,000 Intermediate Scale Map

   The Primary Series Base Map printed in two editions. Surface Management Map depicting land ownership. Surface Mineral Management Map depicting the extent of federally-owned mineral rights overprinted on the Surface Management edition. Topography is available for some quads. Sheet size is 42" x 30". Revision is every seven years; intensive use quads every four to five years.

Maps produced on a non-cyclic basis

1. 1"=15 Miles Oregon State Resource Maps

   A highway map with BLM recreational data, text, and graphics. Folded to a 4" x 8" format. Revision as demand requires.

2. 1" & ½"=1 Mile 30' Quad Maps

   Eastern Oregon coverage with land ownership. Revision as requested by Districts.

3. 1:500,000 Oregon State Map

   Land ownership and topography shown. Revision as demand requires.

4. 1:1,000,000 Oregon State Map

   Reduction of 1:500,000 State Map. Revision as demand requires.

Special Cartographic Drafting

1. Environmental Impact Maps

   1:500,000 and/or ½"=1 mile scale. Shows land ownership, vegetation, wildlife habitat, and special management areas.

2. Wilderness EIS Map - Statewide Volume

   1:1,000,000 Oregon State Map. Shows land ownership and Wilderness Study Area boundaries.

3. Wilderness EIS Map - Appendices

   ½"=1 mile and 1:1,000,000. Individual Study Area Maps showing land ownership, special management areas and potential mineral or energy resources.

CHAPTER 203 - ORTHOPHOTOGRAPHY

Regional Program

Orthophoto coverage will be in the 7½' quadrangle format (1:24,000), identical to the USGS Topographic Series base maps.

The Orthophotography Unit has on file 1:24,000 scale, 7½' orthophoto quadrangles (nagatives) made from high altitude aerial photographs (HAP). Scales attainable from these negatives are ½" to 8" to the mile.

Definition of Orthophotography

Because standard aerial photography contains inherent distortions such as relief displacement, the photo image shifts from its true position. As a result of this shift, the scale will vary from point to point throughout the photograph.

When the effect of this relief displacement and other distortions are eliminated, photo images will be in their true horizontal position and the scale will be uniform throughout the photographic area. This product is an orthographic photographic projection, commonly referred to as an orthophoto.

Methods

The current method of producing the orthophoto is to profile scan the stereo model along lines spaced at predetermined intervals. This is accomplished using the Wild OR-1 scanner. The procedure collects and records digital data that may be manipulated through a computer to produce a drive tape that controls the orthophoto projection. The profile tape may also be used to generate Digital Elevation Models such as perspective plots and contour maps.

Since all visible objects will be imaged on the photograph, the orthophoto will show information that may have been considered not worthy of representation on a map. For example, agricultural and vegetative patterns and transportation networks are visible, but may not be applied to the map.

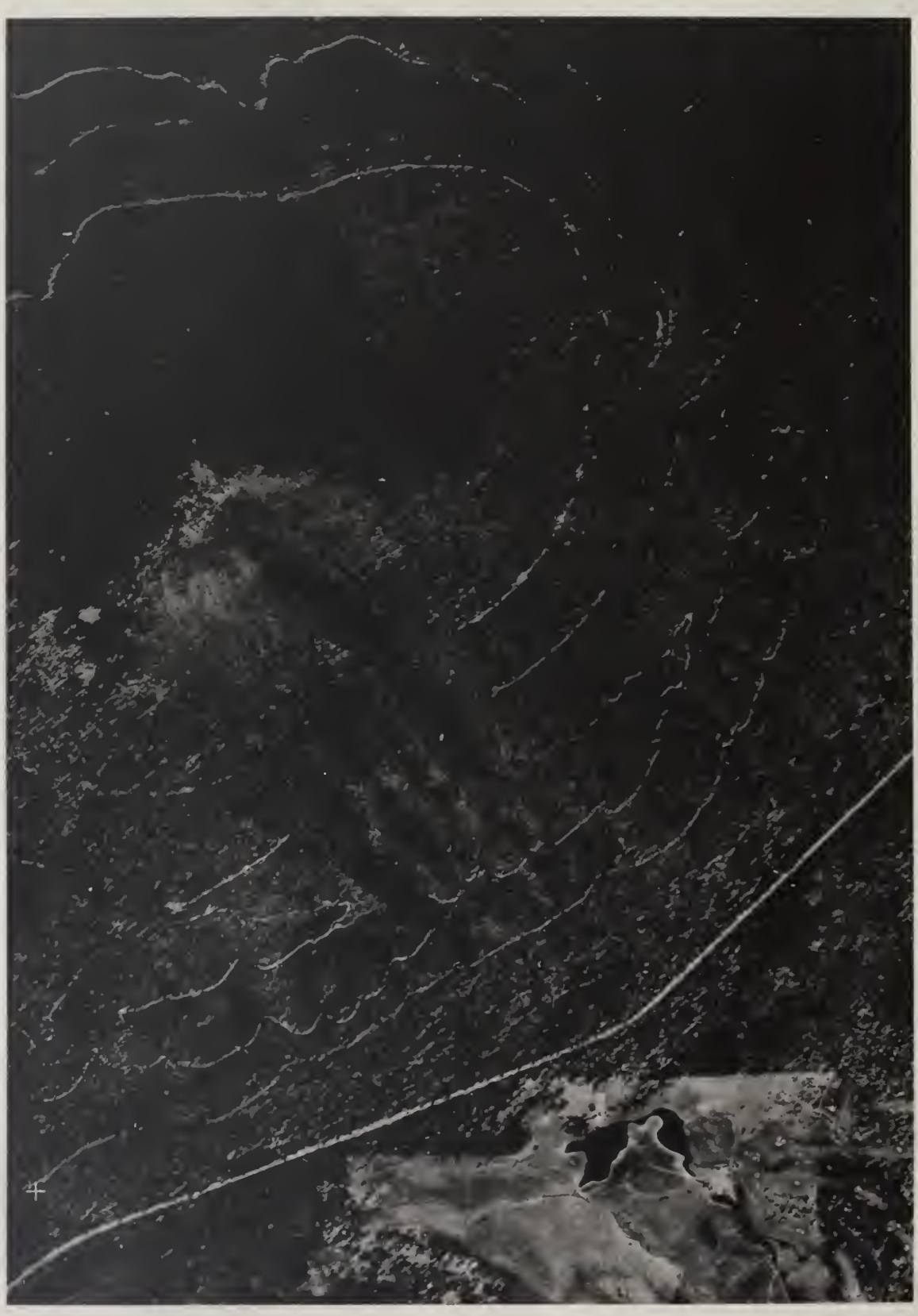
Typical Uses of Ortho Products

1. Planning
2. Design Work
3. Updating of a Primary Base Series
4. Indexing
5. Data Bases

ORTHOPHOTO

Scale - 1:24,000

Orthophoto negatives on continuous-tone film of each 7½' quadrangle will be filed in the State Office. Orthophoto prints can be produced on Cronopaque film or continuous-tone paper.



CHAPTER 204 - GEOGRAPHIC INFORMATION SYSTEM

1. Supply need for funding for Land Records Information System/ Geographic Information System interface - Dollars.

2. Set up base funding program as annual commitment for data base development.

3. Set up Bureau of Land Management Map Advisory Committee for both automated and manual map production to provide priorities.

4. Briefing of Geographic Information Systems to Bureau of Land Management personnel.

Automated Geographic Information System

I. Introduction

The primary funding for data capture would be project oriented, using individual benefiting subactivity funds. Current costs to digitize the data are equitable to former acreage measurement functions performed in the districts. The major cost savings are gained with repeated use of the same data; i.e., surface water data digitized for range suitability modeling can be used for wildlife analysis, oil and gas APD's, and most other activities.

The flexibility of auto-GIS greatly exceeds all other digital/manual resource information systems. The user has the ability to both interact with their own data and other data within the system. This ability to automatically overlay and analyze many layers of map data has been proven.

Terminology

A. Cartographic Modeling: The process of combining different layers of map information in a predetermined manner to create a new, synthesized product. The planner can then use the cartographic model as a base for decision making.

B. Cell (Rastor) Data: Cell maps are those that display data to a predefined grid system, i.e., each cell represents a 50 x 50 meter area on the ground. Landsat data and digital elevation data (DEM's) are processed in cell format.

C. Coordinate Systems: A mathematically defined method for describing the locations of points on the earth's surface.

D. Data Conversion: The map compilation process to transform data from a non-map to a positionally correct, coordinate referenced map. This process can be manual, optical, photogrammetric, or digital.

E. Digital Elevation Model (DEM): A USGS product where metric terrain elevation data is stored in a 30 x 30 meter grid system on digital computer tapes. DEM's are used to produce automated slope, aspect, and three dimensional plots.

F. Digital Plotter: A computer device that draws/plots two or three dimensional maps, drawings, or diagrams.

G. Digitizing: Computer data entry using a graphics tablet that encodes map coordinates for points, lines, and area (polygons) mapped data. Most digitizing is manual where the operator traces the line to be computer encoded. Scan digitizing (automated) may be economical in the near future.

H. Geographic Coordinates: Coordinates expressed as latitude and longitude of a point on the earth's surface.

I. Geographic Information System (GIS): An information system that retains geographic integrity by using a coordinate reference system (x, y, z). The GIS stores, analyzes, and displays the geographic reference data. The Bureau's URA map overlays are an example of a manual GIS. This term relates to all computer equipment and software programs and expertise required to produce and manipulate a resource digital data base.

J. Graphics Terminal: A computer terminal designed to display two or three dimensional maps, drawings, or diagrams. Usually more expensive than standard CRT computer terminals.

K. Orthophotoquads: An aerial photograph that had all image displacement/distortion removed and is plotted to a map projection. An orthophotoquad is a two dimensional map. Orthophotoquads produced cooperatively by USGS on a 7.5 minute, 1:24,000 scale similar to the topographic maps.

L. Planimetric Map: A two dimensional map which normally depicts cultural features and other two dimensional data.

M. Polygon Data (Vector): A closed plane figure having three or more sides. Polygon and vector terms are used synonymously with line maps. Examples include soil maps, forestry type maps, and range site (SWA) overlays. The ADS/MOSS system is primarily a polygon/vector system with a cell processing subsystem.

N. Remote Sensing. Any method of obtaining precise information about the extent and condition of a physical feature without being in actual touching contact with this feature. Aircraft and satellite are common Bureau platforms from which data are obtained. Data collection systems located on these platforms may include camera, video TV, photographic, energy scanner, radar, and other sensors which employ electric, magnetic, gravity, or electromagnetic energy.

O. Spatial Data: Data that can be related to a place. The portion of the data that links the data to a place is the locational identifier. In a GIS the locational identifier is coordinates. Examples of spatial data are topographic maps, aerial photography, Landsat data, and computer generated symbolic maps.

P. Thematic Maps: A map that portrays selected phenomena or themes for a special purpose, i.e., a land ownership map. Can refer to a layer of data stored in a GIS.

Q. Topographic Maps: A three dimensional map representation of the earth's terrain. The normal USGS topographic map uses contour lines to represent the terrain. They are produced in the 7.5 minute, 1:24,000 scale map for most of Wyoming.

R. UTM Coordinate System: Universal Tranverse Mercator is a metric plane coordinate system used to reference locations of points on a plan projection of the earth's surface in meters. UTM is the MOSS reference system.

II. System Capabilities

A. Storage: The State Office system has the capability to store over 10,000 layers (map overlays) which is 1200 MBytes of data online for immediate field use. An unlimited amount of data may be stored on the two removable disks or on magnetic tapes.

B. Analytical/Modeling: The existing software can give occurence counts, linear (point to point or stream) distances, perimeter, area (acreage), or volume measurements from one map overlay or a composite of several overlays. A feature from one map may be statistically merged with data from another layer. Buffer zones can be automatically generated. A new subsystem will allow for detailed horizontal processing and much stronger modeling with cell data, i.e., slope, aspect, visibility, contouring, proximity, etc. Statistics can be printed out on the terminal screen or on a line printer.

C. Graphic Plots: Quick page size plots can be made from the screen on the field hard copy devices. Large permanent map plots can be produced by the State Office on both paper or film overlays. The plots can be preliminary or finished color maps with titles and legends. Single one piece plots can range up to three feet by six feet. The field office can request the plot from the central computer. Plot scale/size can be determined by the requestor.

III. System Hardware and Software

A. Hardware: The attached diagram identifies the system hardware.

B. Software: The system's computer programs are divided into six software sets.

1. AOS (Advanced Operating System): This software is the Data General computer operating system. All other software uses this AOS package.

2. ADS (Automatic Digitizing System): This software set was designed by the Bureau for digitizing map data. It is oriented to the 7.5 minute, 1:24,000 scale topographic or orthophotoquad maps. This software requires high speed telecommunications (4.8 to 9.6 buad rate or greater) to economically use the digitizing operator. ADS also produces plots.

3. ADS/MOSS: Software used to convert ADS data into MOSS compatible format. MOSS uses UTM coordinates.

4. MOSS (Map Overlay Statistical System): This software furnishes the analytic power to the system. It allows for the analytical compositing of data and produces plots and statistical printouts.

5. COS (Cartographic Output System): This system allows for the graphic design of map plots. They can be formatted for eight different output devices. Produces finished map plots with titles, scales, legends, etc.

6. AMS (Analytical Mapping System): Another map digitizing system used by the FWS (WELUT) and the Colorado State Office. This sytem uses an additional piece of hardware to act as a buffer and to transform data into geographic coordinates. Also AMS has an analytical photogrammetric software set included in its design.

IV. Systems Support

A. State Office

1. GIS Coordination and Project Development: The State Remote Sensing Coordinator provides all state coordination for development, management, and training for the GIS/Remote Sensing Systems.

2. Cartographic Data Base Management: The Cartographic Section coordinates access to the GIS including user codes and data base formats. Standardization is also included within this function.

3. Digitizing (Data Entry): All bulk map digitizing is performed or controlled by the Branch of Information Services. There are three other sources of digitizing; the Denver Service Center, contractors, and the Fish and Wildlife Service. All outside digitizing must be closely inspected to meet system requirements and standard coding.

4. Computer Operations: The Branch of Information Services operates the Data General computer and coordinates access to the computer through the state's telecommunications plan.

B. Digital Remote Sensing Support: The DSC, Branch of Scientific Systems Applications (SSA) (D-442), gives field offices operational support and assistance in using digital image (LANDSAT) processing to produce vegetation cover maps and other excellent products.

C. Software Development: The DSC, Branch of Scientific Systems Development (SSD) (D-441), provides software development and coordinates software compatibility with outside agencies.

D. Special Assistance and Software Development: The Fish and Wildlife Service, Western Energy Land Use Team (WELUT), in Fort Collins, Colorado, provides a special capability for MOSS polygon and cell software development for both MOSS and COS. They also provide excellent training on the use and capabilities of Geographic Information Systems.

E. System Approvals: The Washington Office (AA-870) reviews and approves all computer equipment requests and major system changes or developments.

V. Funding

All digitizing workload greater than one workmonth must be approved through the PAWP/AWP process. Variations from this criteria must have Deputy State Director, Operations, approval. Like all Division of Operations support work, digitizing and plotting will be funded by the benefiting subactivity.

VI. Project Sequence

A. Project Flow

1. District offices request support prior to the PAWP process. Request should include those projects in the Planning Schedule. Include identification of analytical needs; i.e., coal volume in tons for high-moderate zones under alluvial valley floors, coal unsuitability statistics, or range suitability map/acreages for slope/distance to water criteria. District offices should appoint a project coordinator.

2. Workload analysis and coordinates support estimates.

3. District office PAWP request including funding type.

4. AWP process.

5. District/State Office project design.

6. District office resource data collection, inventory, or identification and map overlay compilation on 7.5 minute, 1:24,000 scale topographic maps or orthophoto-quads.

7. Digitizing and proof plots.

8. District office edit of proof plots.

9. Entry of data into MOSS Data Base.

10. District office analytical use of data from field terminals. This process may be performed by the State Office on request.

11. Long term storage and use of data.

B. Project Support

Some large projects (RMP's) are started with the DSC, Branch of Scientific Systems Applications (SSD) (D-442), support for digital remote sensing for a large area vegetation cover map, slope, aspect products, and range suitability. The State Office coordinates this work and any additional digitizing requirements.

C. Digitizing Estimates (ADS)

Data Types	Workdays per 7.5' Map
Land net and ownership compilation and digitizing	1.0 - 1.5
Soils (Order III)	1.5 - 3.0
Range sites and soils with allotments	2.5 - 4.0
Surface water, streams, and point sources	0.25
Slope (if DEM available)	0.5
Aspect (if DEM available)	0.5
3-D plot (if DEM available)	0.5
Cultural data	0.25
Transportation	0.5

D. Standard Data Bases

The Division of Operations has provided for a standard compilation mapping base for all BLM high interest areas. This base includes the 7.5 minute, 1:24,000 scale orthophotoquad and/or the topographic map. Stable base film copies can be ordered from Oregon State Office photo lab. This base map provides input coordinates for all data digitizing.

VII. Operational Integration

A. Coordinated data capture and standards between the field offices and the State Office.

B. Integration of DSC's Landsat Vegetation Cover Data into the State Office system for field use.

C. Networking equipment access to field offices and other systems.

D. Training all resource specialists, technicians, and management in the use of the system.

E. Documenting operational procedures and data availability.

F. Developing long term system maintenance procedures and funding.

G. Development of a coordinated resource master data base design.

H. Planning for expansion of the system to include greater field office storage, access, analytical, and plotting capabilities.

I. Developing specific applications for various field activity needs.

J. Design a security system which includes adequate protection for data both on and offsite.

VIII. Implementation

A. A well designed and carefully executed initial district office pilot project.

B. Continuous user involvement throughout the project.

C. The availability of a staff skilled in the organization and management of a project. Also a staff skilled in the interactive graphic systems.

D. Consistent work flow is critical.

E. District office participation is mandatory, especially for data integrity and editing functions.

F. Management must fully support the project from inception to final use of the system output statistics.

G. A single point of contact at the resource area, district, and State Offices.

H. Identification of output/final needs at the project inception.

Photoreproduction

CHAPTER 205 - PHOTOREPRODUCTION

Guidelines for ordering services

I. "Original" or "Source" materials used for reproduction:

A. When furnished by District - special requirements:

1. Scale of the original material must be provided.

2. Work maps included with the job should be labeled with the District name and requisition number.

3. Originals should be labeled "Please return to District".

B. When furnished by State Office - special requirements:

1. Be familiar with original material stored at State Office and its use.

a. U.S.G.S. Topographic Map - 7½' or 15'.

b. Primary Base Series (1:100,000) - with or without topography.

c. Planimetric Base Map, # _____.
(Old base map)
Topography is not to be included.

C. Special Order

When original material required is not available at the District or State office and must be ordered for a special job from another source such as the U.S.G.S., please consult the Photoreproduction Coordinator.

II. Specific information needed for each job:

A. Desired scale of final product.

B. Enlargement factor (150%, 200%, ?).

C. Finished size. Keep in mind limiting factors such as:
-- Maximum film width is 42"
-- Maximum paper width is 42"
-- Halftone screen is 32" x 42"

D. Will final product be split East-to-West or North-to-South?

E. Should the final product be in one piece?

F. Should one or more layers be screened? How much? (50%, 20%, ?).

G. What is the projected use for the final product?

1. To produce Blueline prints
2. Timber sale
3. For publication (highest quality needed)
4. Working tool (lowest quality and cost)
5. To be reproduced or not?
6. Quality - not important? Vital?

Turnaround Time

Turnaround time varies from job to job depending on such things as:

1. Size of the job.
2. Completeness of request. If, for instance, the form is improperly filled out and the Coordinator cannot contact the requester, time will be wasted.
3. Location of originals.
4. Current work load at State office.
5. Number of "steps" involved with other units to complete the job. The Photoreproduction Coordinator will assist in estimating the time involved for each step of the process.

When estimating the number of days between order date and due date, count only government work days. Normal turnaround time for a "one step" job (job goes directly to the contractor), would be approximately 3-5 weeks.

Jobs with "ASAP" for the due date are handled like a normal job.

If a job is required by a specific date, it should be emphasized on Request Form. If necessary, request that the Photoreproduction Coordinator contact you if the job cannot be completed by a given date.

Photoreproduction Terminology

CONTACT PRINT:	Same size print made with reproduction material in contact with the original or intermediate.
CONTACT SCREEN:	A halftone screen made on film base and having a graded dot pattern. It is used in direct contact printing.
CONTINUOUS TONE:	Photographic image made up of infinite gradations of gray densities from black through white. Opposed to line image which has either black or white with no gradation between.
CONTRAST:	Relative difference in density between dark and light areas of a reproduction.
COPY NEGATIVE:	A negative made as an intermediate to produce prints.
CRONAPAQUE:	Polyester print film, consisting of high speed, variable contrast emulsion on white, semi-opaque base.
DEFINITION:	Relative sharpness of photographic images.
DENSITY:	A numerical measure of the blackening, or light-stopping ability, of a photographic image.
EMULSION:	The light-sensitive coating of a photographic material, mainly silver salts suspended in gelatin.
EMULSION SPEED:	The rate of response of a photographic emulsion to light, determined under standard conditions of exposure and subsequent development.
ENLARGEMENT:	Optical projection to increase size of original; projection to original size from microfilm or reduced size negatives.
EXPOSURE:	The quantity of light which is allowed to act on a photographic material. The product of the intensity and the duration of the light acting on the emulsions.
FOG:	A veil of silver of low density on a photographic material. Most commonly caused by non-image light striking the material or by incorrect chemical treatment.

GENERATION: Each succeeding stage in photographic reproduction from original copy.

HALFTONE: A tone pattern composed of dots of uniform density but varying in size.

HALFTONE SCREEN: A screen placed in front of the negative material in a process camera to break up a continuous-tone image into dots of black and white to produce a half-tone. There are two types: ruled glass screens and contact screens.

DENSITOMETER: An instrument for making density measurements.

DIMENSIONAL STABILITY: The relative ability of materials to resit changes in size caused by temperature, relative humidity, processing and aging.

DIRECT POSITIVE: Positive to positive, or negative to negative, reproduction without intermediate steps.

DRAWDOWN (or Pumpdown): Action of vacuum in printing frame causing original and reproduction materials to be in close contact during exposure.

DROP-OUT: Portions of originals that do not reproduce, especially colored lines or background areas (often on purpose).

HIGHLIGHT: The lightest portion of a picture. In a negative, the highlights are the areas of highest density, since these correspond to the lightest areas of the original.

LINE COPY: Original consisting of only two tones, generally black and white.

MASKING: Using opaque material to cut off exposures to certain areas of reproductions to produce desirable effects.

MATTE: In reproduction, a relatively rough, low-gloss surface particularly suited to drafting in either pencil or ink.

NEGATIVE: The image obtained from the original in the conventional photographic process. The tones are the reverse of those in the original subject.

OVERLAY: Transparent or translucent prints, which, when placed one on the other, form a composite picture.

POSITIVE: A photographic image, usually made from a negative, in which the tones are not reversed as in a negative. A positive on paper is usually called a "print", and one on a transparent base, such as film, is called a "positive transparency".

REVERSE READING (Wrong Reading, Left Reading): Lateral reversal; mirror image-transposed left to right, emulsion down as image is read correctly.

RIGHT READING: A photographic image readable from the emulsion side.

SHADOW: The darkest portions of a picture. In a negative, the low-density areas are called the "shadow areas", because they correspond to the high-density (dark) portions of the original.

FILM

LINE EMULSION (Clear base)

CRONAFLEX (Matte finish)

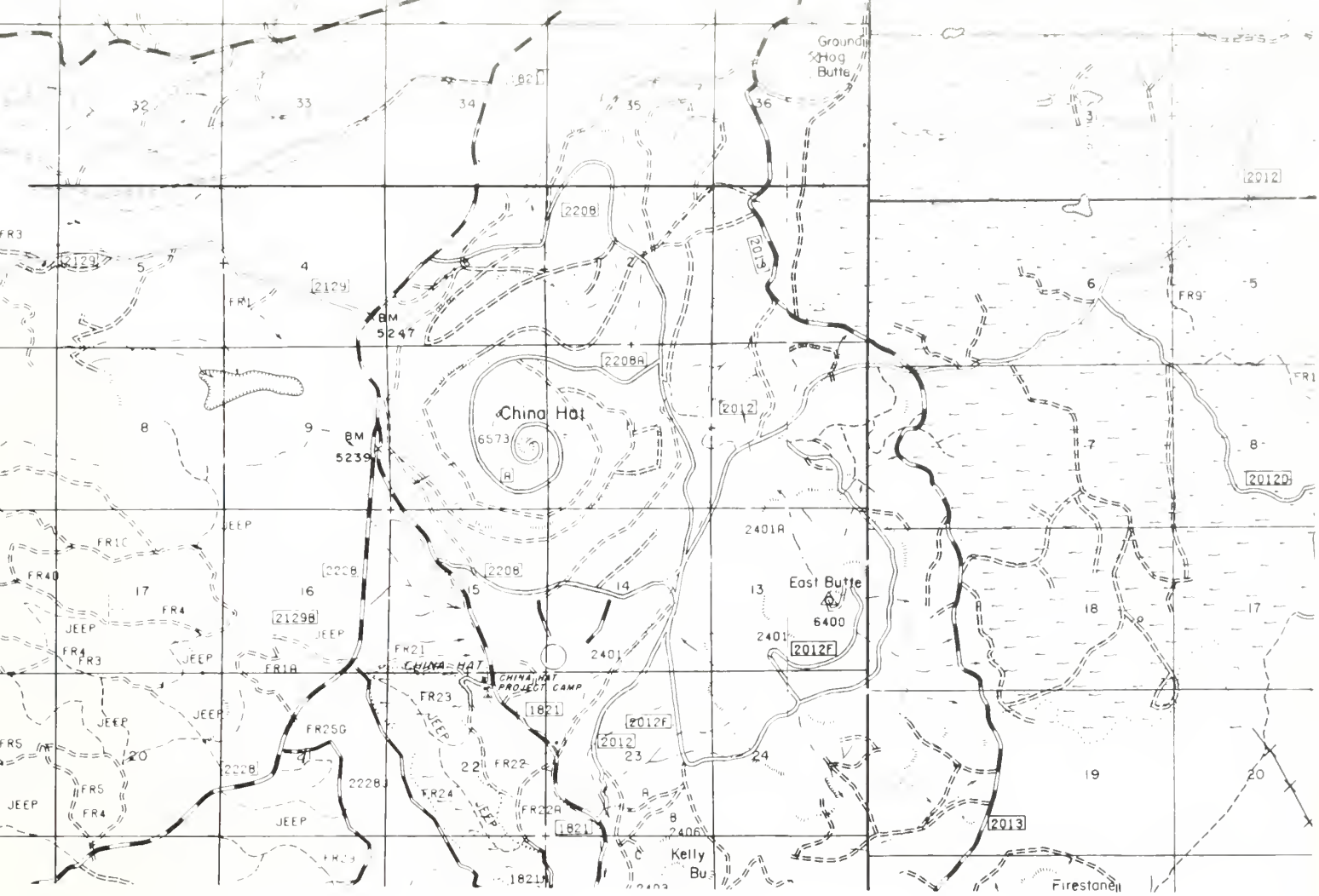
- Made from positive or negative transparent line-copy original.
- No distortion is scale.
- Will accept additions in pencil or ink.
- Maximum material size, 42" wide x any length.

FILM

LINE EMULSION (Clear base)
CRONAFLEX (Matte finish)

- Made from positive or negative transparent line-copy original.
- Made from positive or negative transparent line copy original.
- No distortion is scale.
- No distortion in scale.
- Maximum material size, 42" wide x any length.
- Will accept additions in pencil or ink.

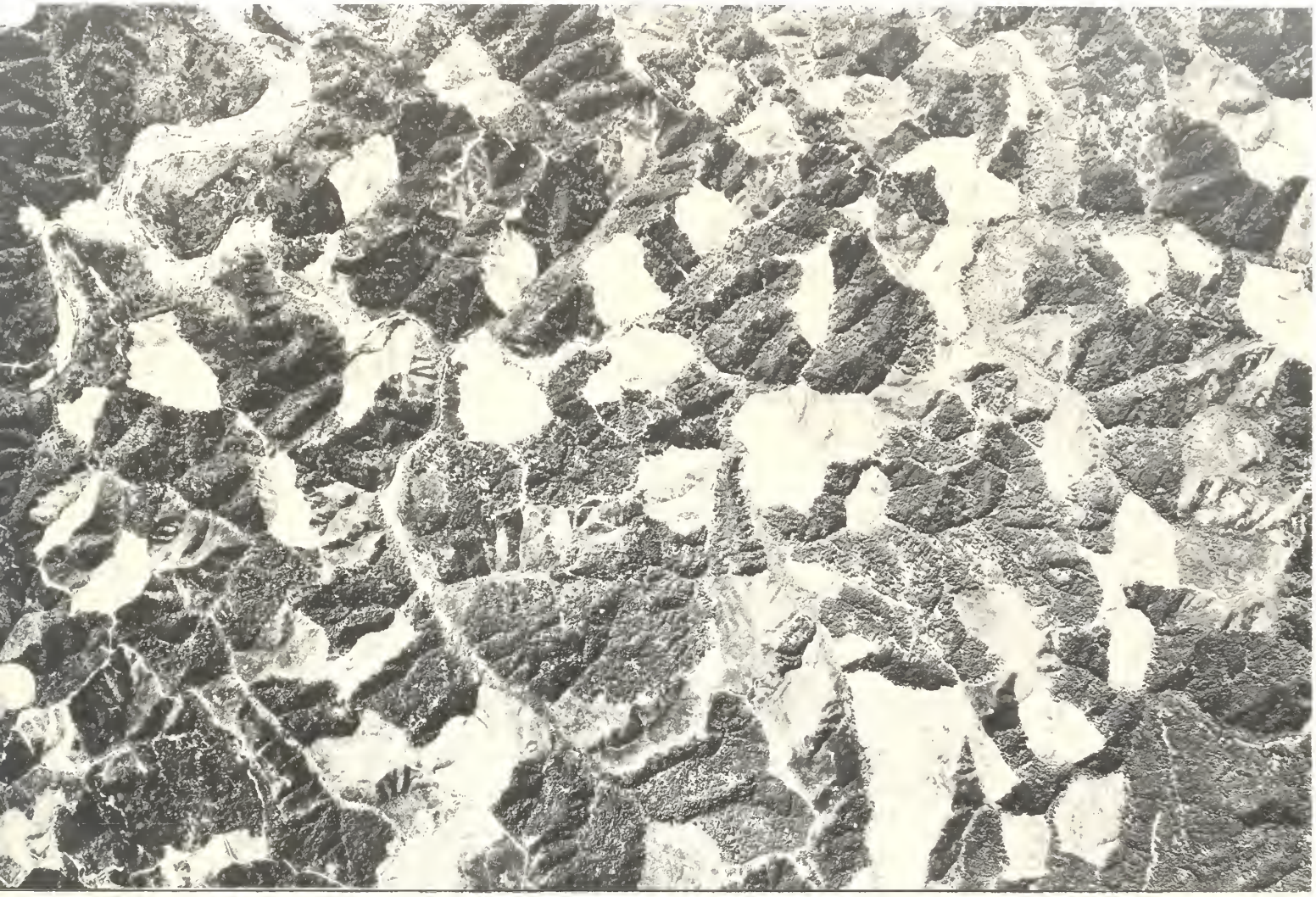
- Maximum material size, 42" wide x any length.



Photographic Paper

LINE EMULSION ON OPAQUE PAPER

- Made from positive or negative transparent original.
- Little or no distortion in scale.
- Maximum material size, 42" wide x any length



FILM

CRONAPAQUE

- Made from continuous-tone negative original.
- No distortion in scale.
- Maximum material size, 42" wide x any length.

CHAPTER 206 - REMOTE SENSING

REMOTE SENSING

In applications of remote sensing, imagery may be acquired not only through the use of a conventional camera system, but also by recording the scene through one or more special sensors. These special sensors usually operate by electronic scanning, using radiations outside the normal visual range of the film and camera, i.e., microwave, radar, thermal infrared, ultraviolet and multispectral. Special techniques are applied in order to process and interpret remote sensing imagery for the purpose of producing conventional maps, thematic maps, and resource surveys.

Remote sensing is related to aerial photography, etc., but does not always include satellite imagery.

Remote sensing products are generally acquired from NASA of the EROS Data Center. NASA photography is available at a variety of scales and film emulsions, and can be used for general resource management and planning.

EROS photography is acquired via satellite. Each scene (9x9 image) is 110 miles on a side. The satellite has a system that scans the earth's surface and records what it senses in a computer format The unit of land being sensed is called a "pixel" which covers about 1.1 acres. Thousands of pixels make up a scale that covers an area 110 miles square. Each pixel is assigned a reflectance value according to what dominates that acre of land. The values can be assigned characteristics through field checking and comparison with maps and aerial photography. The USGS produces color or color infrared photographs of the scenes by assigning colors to the values that correspond to photography that has been obtained by conventional methods.

For additional information regarding Remote Sensing, please contact the Cartography Section of Cadastral Branch, Division of Operations.

CHAPTER 300 - PHOTOGRAMMETRY UNIT

The Photogrammetry Unit specializes in the application of photogrammetric methods and techniques and aerial photography in support of cadastral survey, engineering, and resource management activities.

Standard products and services provided by the Photogrammetry Unit include assistance in map control surveys, site plans, timber sale maps, area topographic maps, road corridor studies, aerotriangulation, terrestrial photogrammetry, remote sensing, and aerial photography. The Photogrammetry Unit also provides consultation and training in all phases of photogrammetric engineering.

It is our intention to establish and maintain close professional contact within the districts to insure continuing understanding in bringing photogrammetric methods and products to full user capability.

1. GUIDELINES FOR ORDERING PHOTOGRAMMETRIC SERVICES

Requests for aerial photography should include:

1. Project name.
2. Required photo-scale and F.L., if known.
3. The area to be photographed.
4. Type of film (color, color infrared, black and white).
5. Special conditions (targets, required flight date, early delivery, etc.).
6. District contact.

If assistance is required in ordering aerial photography regarding photo-scale, type of film or any other problems, we encourage you to contact the appropriate personnel in the Photogrammetry Unit regarding your particular need.

Photogrammetric Job Request Form:

A Photogrammetric Job Request Form is required for every project which the districts wish to have mapped by the Photogrammetry Unit of the Cartographic Section.

Please note that this form only orders the photogrammetric mapping and not the aerial photography required to complete the mapping. The aerial photography must be ordered separately.

If the district is requesting several projects from one area, please prepare a form for each individual project even though the information may be the same, each project is handled separately in Cartography when performing the work. It should be emphasized to the district people that all requests funnel through the District Mapping Coordinator, and then to the State Office.

When preparing the Photogrammetric Job Request Form, the following items must be included:

1. Project name.

2. Mapping scale and contour interval.

3. Any special detail to be mapped.

4. Vicinity map with mapping boundary delineated.

5. Required completion date.

6. Special conditions that might involve the map production.

If assistance is required when ordering photogrammetric compilation, we encourage you to contact the appropriate personnel in the Photogrammetry Unit.

II. FIELD CONTROL REQUIREMENTS FOR PHOTOGRAMMETRY PROJECTS

Photo-control point locations differ for photogrammetric projects which are fully controlled by field surveys and those for which control extension is accomplished by aerotriangulation. An ideal situation requires that the stereoscopic model in a project contain at least three horizontal and four vertical photo-control points. For example, targeted points normally can serve as horizontal and/or vertical control stations. Horizontal control surveys are necessary to establish scale, azimuth, and in most cases, a coordinate system. Vertical control is required to level the model and establish a vertical datum for the project.

Targeting:

In planning for targeting a project, the following should be considered. Targets should be placed at any existing control falling within the proposed limits of photography. Targets provide a precise, reliable image point which can virtually eliminate misidentification problems. The size of targets set is determined by the scale of the aerial photography. A general rule for minimum size is 0.01" of the photo scale for the longest dimension, and the width should be about 0.20" of the length.

Before placing any targets on the ground, we encourage you to contact the appropriate personnel in the Photogrammetric Unit.

PHOTOGRAMMETRIC JOB REQUEST

District Coordinator:_____ Date of Request_____

This sheet was prepared by_____ Target date _____

Project Name _____ District Office _____

District _____ Acres _____ Work Units _____

District Contact _____ Phone No. _____ FTS

Intended use of this project (such as site plan, timber sale, etc.):

_____

Project is outlined on the accompanying Map Photo

Final products desired are: MAP at _____ (scale) with _____ foot contour intervals; ORTHOPHOTO at_____ (scale) composited with map or separate.

The District will be able to furnish ground survey (Consult with S.O. before initiating survey)

The District will not be able to furnish ground surveys.

Mapping sheets and/or orthophoto sheets needed by District are _____ cronaflex positives; _____ ozalids of each sheet.

REMARKS: _____

_____

_____

_____

CHAPTER 301 - AERIAL PHOTOGRAPHY

The Photogrammetric Unit is equipped to provide information of vertical and oblique aerial photography in color, color infrared, or black and white, which is accomplished by contract.

The ultimate goal of the unit is to provide quality, precise aerial photography in a timely manner.

Types of Aerial Photography available are:

I. SPECIAL PURPOSE PHOTOGRAPHY (SPP). Generally encompasses projects less than 100 square miles with photo scales usually 1:12,000 and larger. Please note that an order for SPP does not constitute an order for photogrammetric mapping. A Photogrammetric Job Request Form must be completed to order photogrammetric mapping.

All requested flights for SPP will be made as early as possible between March 15 and September 30.

II. OBLIQUE AERIAL PHOTOGRAPHY. The Aerial Photography Unit will continue to contract for oblique photography.

Oblique photography scales are measured at the near foreground. For intensive study, a scale of 1:6,000 to 1:10,000 is typical. For large area land use studies and fire-preattach, a scale of 1:16,000 is generally used. Obliques will be delivered in February. Please note, however, that most projects take two years to complete.

Schedule for Resource Inventory Photography (RMP)

FY 1984 Eugene District
FY 1985 Medford District
FY 1986 Coos Bay District
FY 1987 Salem District
FY 1988 Roseburg District

Assistance concerning Special Purpose Photography, Resource Inventory Photography, and High Altitude Photography should be directed to the Photogrammetric Unit, Cartographic Section, Oregon State Office.

CHAPTER 302 - AEROTRIANGULATION

The Photogrammetric Unit is supported by a highly qualified staff using state-of-the-art technology to perform aerotriangulation and map compilation by photogrammetric methods.

Aerotriangulation, often referred to as "bridging", is the process of extending horizontal and vertical control photogrammetrically. Aerotriangulation is traditionally used to provide extension control for mapping, but may also be used as a survey method. Sufficient ground control must be available to form a basis from which the control extension may be made. Photogrammetric coordinates are then read on these points and points for which positions are desired. Through the process of a strip or block adjustment, ground coordinates are calculated for the unknown points. Accuracies of 1/10,000 of the flying height can be achieved with relative ease.

Some non-mapping uses of aerotriangulation are:

1. Establishing a horizontal and vertical control network in a project area to tie adjoining surveys.

2. Cadastral surveys.

3. Right-of-way surveys.

Photogrammetric Compilation

CHAPTER 303 - PHOTOGRAMMETRIC COMPILATION

Mapping procedures have changed considerably since the days when topographic maps were sketched by hand in the field. Today most maps are compiled in the office by photogrammetric methods using aerial photographs and complex stereoscopic plotting instruments. Through the lens of an aerial camera, the terrain is recorded from points thousands of feet above in a planned series of overlapping exposures. The resulting photographs are viewed as pairs through a plotting instrument having an optical system that causes the left eye to see one photo and the right eye to see the other. The resulting view is a three-dimensional stereomodel of the terrain from which the compiler can precisely delineate contours, drainage, woodland, and culture.

Some of the products available from this unit are:

1. Site plans - (page 303-2) - mapping or digitizing from large scale photography. Final map scales range from 1"=40' up to 1"=200' with contour intervals from 2' to 10'.

2. Timber Sale Mapping - (page 303-3) - mapping or digitizing from medium scale photography (1:12,000, 1:15,840, 1:24,000). Final map scales are generally smaller than 1"=200'. Contour intervals range from 10' to 20'.

3. Area Topo Mapping - (page 303-4) - mapping or digitizing from High Altitude Photography. Final map scales are generally 1"=1,000' and smaller with 40' contours.

4. Non-Traditional applications such as photogrammetric road design and terrestrial photogrammetry are also available. Inquiries concerning this type of product should be addressed to the Chief of Cartography.

5. Orthophotos and ortho-composites are available at all map scales.

The Photogrammetric Compilation Unit is under the direction of Ted Albert, the unit is supported by a capable staff operating state-of-the-art stereo instruments.

CADASTRAL SURVEYS SECTION

CHAPTER 400 - BRANCH OF CADASTRAL SURVEY, OREGON STATE OFFICE

Functional Statement

This branch has the overall responsibility of planning, directing, and coordinating the BLM Cadastral Survey and Cartographic Programs in the states of Oregon and Washington; and also provides cadastral survey support to other federal agencies, including Bureau of Indian Affairs, Forest Service, Park Service, Bureau of Reclamation, and Corps of Engineers.

Special functions include: providing technical and administrative direction to the district cadastral programs in Oregon and Washington; conducting cadastral surveys on a reimbursable basis for other federal agencies; verification and examination of survey returns (plats and notes); approval and acceptance of all types of cadastral surveys and supplemental plats; approval of all types of protracted surveys; action on survey protests and appeals; responding to public inquiries; preparation of special purpose maps required by BLM resource activities; and providing photogrammetric services to the State Office and district programs.

Organizational Structure

The organization structure of the branch includes three operational sections consisting of (1) Cadastral Field Section, (2) Cadastral Office Section, and (3) Cadastral Survey Returns Section. The general functions of each section are as follows:

Cadastral field Section

1. Conducts surveys, on a reimbursable basis, for other federal agencies in Oregon and Washington.

2. Conducts surveys for the Forest Service under the 9800 and 4530 programs.

3. Provides technical direction and support to the district cadastral programs in Oregon and Washington.

4. Conducts investigations and reports on unusual or complex field conditions in Oregon and Washington.

Cadastral Office Section

1. Provides policy development; program/budget direction and AWP development; and the coordination, evaluation, and monitoring of the cadastral survey and cartographic programs.

942 - Branch of Cadastral Survey:

The Cadastral Survey Program in Oregon and Washington is responsible for planning, directing and approval of official surveys of the public lands in support of BLM programs, and also in support of other federal agencies, including the FS, BIA, National Park Service (NPS) and Fish and Wildlife Service (F&WS).

The State Office provides technical direction to District programs; conducts reimbursable surveys for other federal agencies, verifies and examines survey returns (plats and notes); approves and accepts all cadastral surveys and supplemental plats; and has lead responsibility for survey protests and appeals.

The Cartographic Program is organizationally under the Branch of Cadastral Survey, and is responsible for the preparation, compilation, and construction of special purpose maps and other cartographic products required by the District and State Office staffs. The unit also provides control surveys at the District's request, administers aerial photography contracts, does plotter-generated maps, and provides assistance to resource managers on the application and capabilities of remote sensing.

Present Staff

At the present staffing level, 600 workmonths are involved in this activity. They are broken down as follows:

Management -	8
Program Coordination/Review -	11
Cadastral Survey (Reimbursable)-	291
Cadastral Survey (BLM) -	105
Mapping -	85
Aerial Photography -	8
Photo Lab -	10
Budget -	5
Research/Special Instructions -	22
Administration -	12
Clerical -	12
Plat Preparation -	31

The existing staff has an adequate skill/age mix and no problems are anticipated relative to availability of skills to meet future cadastral and cartographic needs. The only area of concern will be the need to train individuals to accommodate the sophisticated Landsat and automated cartographic processes as they become operational.

Program Trends

1. The survey returns backlog will be eliminated within the five year time frame; possibly within the next two years.

2. The decentralization of BLM's surveying responsibilities to District Offices will increase the need for technical and program guidance beyond the level that has been provided in the past.

3. The state of the art relative to cadastral surveying is constantly changing. Methods of determining positions accurately and faster are being brought about by new technology and hardware. Computerized systems will become standard for both field and office forces. The state of the art procedures and equipment requires skills in geodetic surveying and computer sciences.

4. The OSC mapping program will undergo significant changes within the next three to five years. This will be brought about by the advent of digital mapping.

Skill Needs

Our skill needs will remain approximately the same. The basic skills and expertise required to meet program needs within the next five years are available within the Bureau and no problems are anticipated in this area. However, some training and development of existing staff will be necessary to accommodate the new anticipated technology.

Oregon State Office Contact

Oregon State Office

Reference

Robert J. Rivers
DSD, Operations
503-231-6876
FTS - 429-6876

William W. Glenn
Chief, Br. of Cadastral Survey
503-231-6882
FTS - 429-6882

1. Cartographic Section, GIS Coordination

   Ted Albert, Chief of Cartography (Photoreproduction)
   503-231-6887, FTS - 429-6887

2. Cartographic Unit

   Judy Nisperos, Lead Cart. Tech.
   503-231-6888, FTS - 429-6888

3. Photogrammetry Unit

   Carl Pearson, Carto. Tech. (Aerial Photography)
   503-231-2173, FTS - 429-2173

   Scott Smith, Cart. Tech. (Photogrammetry)
   503-231-2173, FTS - 429-2173